

REMARKS

Claims 1-28 were presented for examination and were pending in this application. In the latest Office Action, claims 1-8, 12-17, and 28 were rejected, and claims 9-11 and 18-27 were objected to as dependent on a rejected base claim but otherwise allowable. With this amendment, claims 1 and 12 are amended.

Claims 1-4, 7, 8, 12-17, and 28 were rejected as anticipated by U.S. Patent No. 6,011,639 to LaFiandra in view of U.S. Patent No. 5,745,278 to LaFiandra. Because the combination does not disclose or suggest each of the claimed limitations, Applicants respectfully traverse this rejection as to claims 18-28 and respectfully assert that amended claims 1-17 are patentable.

The claimed invention enables electrical connections for a deformable mirror that uses an electro-resistive material (such as a piezoelectric material) to deform the mirror. The electro-resistive material deforms when electrical energy is applied to it via an electrode. A problem that may arise in such deformable mirrors is that the conductors that provide electrical energy to the electrodes can also have unintended effects on the electro-resistive material due to the electrical energy they carry. The claimed invention avoids this problem by running the conductive traces at least partially over the electrodes (electrically isolated, for example, using an insulating layer). In this way, the electrodes shield the electro-resistive material from the conductive traces and thereby avoid any unintended effect of the traces.

For example, claim 1 recites an adaptive optics system that includes “a plurality of conductive traces formed on [an] insulating layer,” which is “formed on the electrode surface of the deformable mirror.” This electrode surface is the surface opposing the reflective surface, so

the electrode surface sits between and thereby shields the conductive traces from the portion of the deformable mirror that is actuated by power to the electrodes. Claim 28 recites a method for manufacturing a deformable mirror for an adaptive optics system that includes the steps of “forming an electrode surface on a back surface of [a] deformable mirror,” “forming an insulating layer on the electrode surface,” and “forming a plurality of conductive traces on the insulating layer.” As with the system of claim 1, the mirror formed by the method of claim 28 has an electrode surface on the back of the mirror, and the insulating layer and conductive traces are formed over the electrode surface. In this way, the electrode surface shields the conductive traces from at least portions of the rest of the deformable mirror, preventing the conductive traces from causing unintentional deformations in the portions of the mirror shielded. Lastly, claim 12 recites a deformable mirror for an adaptive optics system that includes “a plurality of conductive traces . . . at least a portion of some of the conductive traces shielded from the electro-restrictive material by the electrodes.”

Neither LaFiandra ‘639 nor LaFiandra ‘278 discloses any structure that achieves this claimed feature. As shown in FIG. 3 of LaFiandra ‘639, the device incorporates an array of stacked piezoelectric actuators, and between the actuators are electrodes of alternating polarity. This stack structure allows the piezoelectric actuators to operate in parallel electrically and in series mechanically. But because the electrodes are sandwiched between the piezoelectric actuators, the electrodes cannot serve to shield the piezoelectric material from the conductive wires used to connect the electrodes. This is in contrast to the electrodes recited in claims 1 and 28, which are on an opposing or back surface of the deformable mirror. Unlike the stacked structure of LaFiandra ‘639, the claimed structure allows the electrodes to shield the rest of the

deformable mirror (e.g., the electro-resistive material) from the electrical connections made to the electrodes.

LaFiandra '278 discloses a similar stacked piezoelectric and electrode structure as LaFiandra '639, but LaFiandra '278 also discloses that the wire conductors "can be replaced by leads which [sic] are silk screened to the sides of each actuator to accomplish the electrical connections." The examiner thus proposed modifying LaFiandra '639 with LaFiandra '278 to achieve the claimed conductive traces. But even with this modification, the electrodes of the modified structure (which are sandwiched between layers of the actuator stack) cannot shield the piezoelectric material from the silk screened leads (which run down the sides of the actuator stack). This modified structure thus does not have "at least a portion of some of the conductive traces shielded from the electro-restrictive material by the electrodes." Claim 12 is therefore patentable over the cited references as well.

Because the independent claims 1, 12, and 28 are patentable over the combination of LaFiandra '639 and LaFiandra '278, the dependent claims are patentable over those references as well.

Claims 5 and 6 were rejected as made obvious by LaFiandra '639 in view of LaFiandra '278, further in view of U.S. Patent Pub. No. 2002/0131146 to Gee et al. The examiner cited Gee only for its additional disclosure of a protective coating, such as a dielectric material, covering a portion of the conductive traces. Accordingly, the combination of Gee's protective coating onto LaFiandra's device does not render claims 5 and 6 obvious because of the deficiencies in LaFiandra mentioned above.

If the examiner believes for any reason direct contact would help advance the prosecution of this case to allowance, the examiner is encouraged to telephone the undersigned at the number given below.

Respectfully submitted,

J. ELON GRAVES, MALCOLM J. NORTHCOTT,
AND J. CHRISTOPHER SHELTON

Dated: August 26, 2005

By: Robert A. Hulse

Robert A. Hulse, Reg. No. 48,473
Attorney for Applicant
Fenwick & West LLP
801 California Street
Mountain View, CA 94041
Tel.: (415) 875-2444
Fax: (415) 281-1350